

TABLE 23. INSTANTANEOUS RATES OF HEAT GAIN DUE TO TRANSMITTED DIRECT AND DIFFUSE SOLAR RADIATION BY UNSHADED WALLS OF 8-IN HOLLOW GLASS BLOCK OF TYPES II, III, IV, IVA AND V PATTERNS

Multiply the Table 20 Values for Type I by These Percentage Factors

For Clear Atmospheres and 18 Deg Declination, North (August 1)

For 30, 40, and 50 Deg North Latitude

Note: To obtain total instantaneous heat gain add adjusted Table 20 values to the Table 21 values.

INSTANTANEOUS HEAT GAIN DUE TO TRANSMITTED SOLAR RADIATION AS A PERCENTAGE OF TYPE I PATTERN

SUN TIME		TYPE II PATTERN					TYPE III PATTERN				
AM →		N, NW, W, SW	NE	E	SE	S	N, NW, W, SW	NE	E	SE	S
5 a.m.	7 p.m.	100	100	100	100	100	70	70	70	70	70
6	6	100	95	95	90	100	70	65	65	70	70
7	5	100	90	90	90	100	70	65	60	65	70
8	4	100	95	90	90	100	70	65	60	65	70
9	3	100	95	85	90	90	70	65	55	70	65
10	2	100	95	95	95	95	70	70	70	75	65
11	1	100	100	95	95	100	70	70	70	80	75
12		100	100	100	100	100	70	70	70	75	90
	↓										
PM →		N, NE, E, SE	NW	W	SW	S	N, NE, E, SE	NW	W	SW	S
SUN TIME		TYPE IV PATTERN					TYPE IVA PATTERN				
AM →		N, NW, W, SW	NE	E	SE	S	N, NW, W, SW	NE	E	SE	S
5 a.m.	7 p.m.	55	45	35	75	55	55	45	35	30	55
6	6	55	45	35	80	55	55	35	35	30	55
7	5	55	45	35	60	55	55	35	40	35	55
8	4	55	45	30	40	55	55	45	45	45	55
9	3	55	50	25	30	60	55	50	65	65	60
10	2	55	55	35	30	50	55	55	85	90	60
11	1	55	55	45	35	40	55	55	70	105	95
12		55	55	55	50	45	55	55	65	100	115
	↓										
PM →		N, NE, E, SE	NW	W	SW	S	N, NE, E, SE	NW	W	SW	S
SUN TIME		TYPE V PATTERN					Designation of Block Type				
AM →		N, NW, W, SW	NE	E	SE	S	II—Semi-Light Diffusing				
5 a.m.	7 p.m.	60	35	35	30	60	III—Light Diffusing				
6	6	60	35	35	30	60	IV—Light Diffusing				
7	5	60	35	40	35	60	IVA—Light Diffusing				
8	4	60	50	65	50	60	V—Light Directing				
9	3	60	80	90	90	60					
10	2	60	70	105	105	90 ^a					
11	1	60	60	80	110 ^a	105 ^a					
12		60	60	60	85	115 ^a					
	↓										
PM →		N, NE, E, SE	NW	W	SW	S					

^a Reduce by 30% for 30 deg N latitude only.

TABLE 24. APPROXIMATE CORRECTIONS TO TABLES 17 AND 21 FOR DEVIATIONS FROM INDOOR AND OUTDOOR DESIGN TEMPERATURES

For each degree the design room temperature exceeds 75 F, subtract correction. For each degree the design outdoor dry-bulb temperature exceeds 95 F, add correction. Apply these corrections to each value in Table 17 or Table 21.

GLASS TYPE	CORRECTION BTU PER (HR) (SQ FT)
Single Glass	1.0
Double Glass and Glass Block	0.5

centages given in Table 23. Note that corrections are the same for all latitudes, and that they vary only on the surfaces exposed to the direct sun. The convection and radiation gain values for all blocks are so nearly the same that a single table suffices. Note, however, that corrections must be made for certain hours for east and west facing walls of some patterns.

Example 15. Find the total instantaneous heat gain through an east wall of 8-in. hollow glass block of Type V pattern at 8 a.m. and 50 deg north latitude. The design temperatures are 75 F indoors and 95 F maximum outdoor dry-bulb, clear atmosphere.

Solution. The gain due to transmitted solar radiation is found from Table 20 for Type I pattern. The factor for Type V is found from Table 23. The convection and radiation gain is found from Table 21 (note the footnote).

The total instantaneous heat gain is, from Equation 7a,

$$q = 86 \times 0.65 + 29 \times 1.4 = 96.5 \text{ Btu per (hr)(sq ft)}.$$

Effect of Deviations from Design Conditions

If the outdoor temperature differs from 75 F, or the design outdoor dry-bulb temperature differs from 95 F, corrections can be made to the convection and radiation gain values for flat glass and glass block according to the schedule in Table 24.

The effect of the humid industrial type atmosphere is to cause a considerable reduction in heat gain, if all factors except solar intensity remain the same. Reference 19 gives heat gain values for four orientations at 40 deg north latitude on August 1 for several types of flat glass and glass block, and solar intensities typical of humid industrial atmospheres. These data show that the following approximate reductions, based on total gain for the day, can be expected: 20 percent for all types of glass and glass block in east or west facing walls; 10 percent for south facing flat glass; 5 percent for south facing glass block walls.

Shading of Glass Areas—Design Tables

The effects and possibilities of shading should be carefully investigated whenever the heat gain from glass is a large portion of the cooling load.

Vertical glass, which is not mounted in the plane of the building surface, is partially shaded by the setback. If a vertical window of height l and width w be set back from the plane of the building a distance s , the fraction of the total area of the window which receives direct solar radiation is:

$$G_t = 1 - \frac{r_1 \tan \beta}{\cos \gamma} - r_2 \tan \gamma + \frac{r_1 r_2 \tan \beta \tan \gamma}{\cos \gamma} \quad (10)$$

where

$$r_1 = s/l, r_2 = s/w, \beta = \text{solar altitude, and } \gamma \text{ is the wall solar azimuth (see Fig. 1).}$$

Values of β and γ for various latitudes and August 1 are given in Table 7. Special cases not covered by the tabulated data may be solved analytically;²⁰ however, the design conditions chosen will yield a satisfactory approximation if used without correction for any time during the summer period.

Example 16. Estimate the total instantaneous rate of heat gain for a west window 3 ft wide by 5 ft high, with a setback of 6 in., for August 1 and 40 deg north latitude at 3:00 pm (sun time).

Solution. From Table 16, the instantaneous rate of heat gain, due to transmitted direct and diffuse solar radiation, is 180 Btu per hr. From Table 7, β is 45.5 deg and